

1           1. (Amended) A substrate processing system, comprising:  
2           a vacuum chamber;  
3           a substrate supporter, located within the vacuum chamber, for holding a  
4           substrate;  
5           a gas manifold for introducing process gases into the chamber;  
6           a gas distribution system, coupled to the gas manifold, for distributing the  
7           process gases to the gas manifold from gas sources;  
8           a power supply coupled between the substrate supporter and the gas manifold;  
9           a vacuum system for controlling pressure within the vacuum chamber;  
10          a controller, including a computer, for controlling the gas distribution system,  
11          the power supply and the vacuum system; and  
12          a memory coupled to the controller comprising a computer [usable] readable  
13          medium having a computer readable program code embodied therein for directing operation of  
14          the substrate processing system, the computer readable program code including:  
15           computer readable program code for causing the gas distribution system  
16          to introduce a first process gas comprising a mixture of SiH<sub>4</sub> and N<sub>2</sub>O into the chamber  
17          to deposit a first plasma enhanced CVD layer over the wafer; and  
18           computer readable program code for causing the gas distribution system  
19          to introduce a second process gas comprising He into the chamber to control the  
20          deposition rate of the first layer.

1           2. A substrate processing system as in claim 1 wherein the computer  
2          readable program code for causing the gas distribution system to introduce the first process gas  
3          comprising a mixture of SiH<sub>4</sub> and N<sub>2</sub>O into the chamber controls the introduction of the SiH<sub>4</sub> to  
4          be between 5 to 300 sccm, and the rate of N<sub>2</sub>O to be between 5 to 300 sccm.

1           3. A substrate processing system as in claim 2 wherein the computer  
2          readable program code for causing the gas distribution system to introduce a second process  
3          gas comprising He into the chamber controls the chamber pressure at about 1 to 6 torr.

1           4. A substrate processing system as in claim 3 wherein the computer  
2 readable program code for causing the gas distribution system to introduce the first process gas  
3 comprising a mixture of SiH<sub>4</sub> and N<sub>2</sub>O into the chamber controls the introduction of the SiH<sub>4</sub> to  
4 be at a ratio of between 0.5 to 3 times the amount of N<sub>2</sub>O.

1           5. A substrate processing system as in claim 1 further comprising:  
2           computer readable program code for causing the gas distribution system to  
3 introduce a third process gas comprising NH<sub>3</sub> into the chamber; and  
4           computer readable program code for causing the gas distribution system to  
5 introduce a fourth process gas comprising N<sub>2</sub> into the chamber.

1           6. A substrate processing system as in claim 5 wherein:  
2           the computer readable program code for causing the gas distribution system to  
3 introduce a third process gas comprising NH<sub>3</sub> into the chamber controls the introduction of the  
4 NH<sub>3</sub> to be between a rate of 0 to 300 sccm; and  
5           the computer readable program code for causing the gas distribution system to  
6 introduce a fourth process gas comprising N<sub>2</sub> into the chamber controls the introduction of the  
7 N<sub>2</sub> to be between a rate of 0 to 4000 sccm.

1           7. A substrate processing system as in claim 1 further comprising computer  
2 readable program code for controlling the gas distribution system to operate for a specified  
3 time period.

1           8. A substrate processing system as in claim 7 wherein the computer  
2 readable program code for controlling the gas distribution system to operate for a specified  
3 time period comprises computer readable program code for causing the first plasma enhanced  
4 CVD layer to be formed to a thickness which is an odd multiple, greater than one, of a  
5 wavelength of light to be used in a subsequent process operation on the layer.

1           9. A substrate processing system as in claim 2 wherein the computer  
2 readable program code for causing the gas distribution system to introduce the first process gas

3 comprising a mixture of SiH<sub>4</sub> and N<sub>2</sub>O into the chamber controls the introduction of the SiH<sub>4</sub> to  
4 be between 15 to 160 sccm, and the rate of N<sub>2</sub>O to be between a rate of 15 to 160 sccm.

1 10. A substrate processing system as in claim 9 further comprising:  
2 computer readable program code for causing the gas distribution system to  
3 introduce a third process gas comprising NH<sub>3</sub> into the chamber at a rate of less than 150 sccm;  
4 and  
5 computer readable program code for causing the gas distribution system to  
6 introduce a fourth process gas comprising N<sub>2</sub> into the chamber at a rate of less than 300 sccm.

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1 44. (New) A substrate processing system, comprising:  
2 a process chamber;  
3 a substrate support, located within the vacuum chamber, for supporting a  
4 substrate;  
5 a power supply;  
6 a gas delivery system for delivering process gases into the process chamber;  
7 a controller configured to control the power supply and the gas delivery system;  
8 and  
9 a memory coupled to the controller comprising a computer readable medium  
10 having a computer readable program embodied therein for directing operation of the substrate  
11 processing system, the computer readable program including a first set of computer  
12 instructions for controlling the gas delivery system to introduce selected deposition gases into  
13 the process chamber at deposited gas flow rates, a second set of computer instructions for  
14 controlling the gas delivery system to add a flow of an inert gas to the selected deposition  
15 gases at a flow rate previously determined to achieve a desired low deposition rate from a  
16 plasma enhanced reaction of the selected deposition gases, the desired low deposition rate  
17 being lower than a deposition rate using the selected deposition gases at the deposition gas  
18 flow rates with a lower flow rate of the inert gas, and a third set of computer instructions for  
19 controlling the power supply to supply power to the process chamber to produce a plasma  
20 enhanced reaction of the deposition gases in the process chamber to deposit a film at the low  
21 deposition rate.

1           45. (New) The substrate processing system of claim 44 wherein the inert  
2       gas comprises helium.

1           46. (New) The substrate processing system of claim 44 wherein the selected  
2       deposition gases comprise silane and an oxygen source.

1           47. (New) The substrate processing system of claim 44 wherein the selected  
2       deposition gases comprise silane and nitrous oxide.

1           48. (New) The substrate processing system of claim 44 wherein the selected  
2       deposition gases comprise silane and a nitrogen source.

1           49. (New) The substrate processing system of claim 44 further comprising a  
2       vacuum system for controlling pressure within the process chamber, and wherein the  
3       computer-readable program further comprises a fourth set of computer instructions for  
4       controlling the vacuum system to maintain a chamber pressure in the range of 1-6 Torr, and  
5       wherein the selected deposition gases comprise SiH<sub>4</sub> flowed into the chamber at a rate of 5-300  
6       sccm and N<sub>2</sub>O flowed into the chamber at a rate of 5-300 sccm.

1           50. (New) The substrate processing system of claim 49 further comprising a  
2       heater for heating the substrate, and wherein the computer-readable program further comprises  
3       a fifth set of computer instructions for controlling the heater to heat the substrate to a  
4       temperature in the range of 200-400°C.

1           51. (New) The substrate processing system of claim 50 wherein the  
2       substrate support is spaced from the gas distribution system at a distance in the range of 200-  
3       600 mils.

1           52. (New) The substrate processing system of claim 49 wherein the selected  
2       deposition gases further comprise NH<sub>3</sub> flowed into the chamber at a rate of less than 300 sccm,  
3       and N<sub>2</sub> flowed into the chamber at a rate of less than 4000 sccm.

1           53. (New) A substrate processing system, comprising:  
2       a process chamber;

3                   a substrate support, located within the vacuum chamber, for supporting a  
4                   substrate;  
5                   an RF power supply;  
6                   a heater;  
7                   a gas delivery system for delivering process gases into the process chamber;  
8                   a controller configured to control the power supply and the gas delivery system;  
9                   and

10                  a memory coupled to the controller comprising a computer readable medium  
11                 having a computer readable program embodied therein for directing operation of the substrate  
12                 processing system, the computer readable program including a first set of computer  
13                 instructions for controlling the gas delivery system to flow He into the process chamber at a  
14                 selected flow rate to provide a chamber pressure in the range of 1-6 Torr, a second set of  
15                 computer instructions for controlling the RF power supply to supply power of 50-500 Watts to  
16                 the process chamber, a third set of computer instructions for controlling the heater to heat the  
17                 substrate to a temperature in the range of 200-400°C, a fourth set of computer instructions for  
18                 controlling the gas delivery system to flow SiH<sub>4</sub> at a flow rate of 5-300 sccm into the process  
19                 chamber, and a fifth set of computer instructions to flow N<sub>2</sub>O at a flow rate of 5-300 sccm into  
20                 the process chamber, wherein a ratio of the selected flow rate of He to the combined flow rate  
21                 of SiH<sub>4</sub> and N<sub>2</sub>O is at least 6.25:1 to deposit an antireflective layer on the substrate at a  
22                 deposition rate which is lower than a deposition rate using the same flow rate of SiH<sub>4</sub> and the  
23                 same flow rate of N<sub>2</sub>O with a lower flow rate of He.

1                  54. (New) A substrate processing system, comprising:  
2                   a process chamber;  
3                   a substrate support, located within the vacuum chamber, for supporting a  
4                   substrate;  
5                   a power supply;  
6                   a gas delivery system for delivering process gases into the process chamber;  
7                   a controller configured to control the power supply and the gas delivery system;  
8                   and